We claim:

1. A lasing semiconductor optical amplifier (SOA) apparatus comprising:

   a lasing SOA for amplifying an optical signal traveling through the lasing SOA and outputting a ballast laser signal that acts as a ballast with respect to the amplification of the optical signal;

   a detector positioned proximate the lasing SOA to convert the ballast laser signal to an electrical signal; and

   a power monitor, coupled to the detector, for analyzing the electrical signal and determining a power level of the optical signal.

2. The lasing SOA apparatus of claim 1, wherein the lasing SOA further comprises:

   an input for receiving the optical signal;

   a laser cavity coupled to the input, the laser cavity adapted to amplify the optical signal and output the ballast laser signal; and

   an output coupled to the laser cavity, the output adapted to transmit the optical signal from the lasing SOA.

3. The lasing SOA apparatus of claim 2, wherein the laser cavity comprises:

   a top mirror;

   a bottom mirror;

   an active region positioned between the top mirror and the bottom mirror; and

   a pump coupled to the active region, the pump adapted to increase a carrier density population within the active region.

4. The lasing SOA apparatus of claim 2 wherein the laser cavity is oriented vertically with respect to an amplification path of the optical signal.

5. The lasing SOA apparatus of claim 2 wherein the laser cavity is oriented horizontally with respect to an amplification path of the optical signal.

6. The lasing SOA apparatus of claim 2 wherein the laser cavity is oriented transversely with respect to an amplification path of the optical signal.

7. The lasing SOA apparatus of claim 2 wherein the detector is positioned near the output of the lasing SOA.

8. The lasing SOA apparatus of claim 2 wherein the detector and the lasing SOA are integrated on the same substrate.

9. The lasing SOA apparatus of claim 1 wherein the detector comprises a PIN diode.

10. The lasing SOA apparatus of claim 1 wherein the detector comprises an avalanche photodiode.

11. The lasing SOA apparatus of claim 1 wherein the power monitor comprises a comparator that determines if the lasing SOA is approaching saturation.

12. The lasing SOA apparatus of claim 11 wherein the comparator comprises a Schmitt trigger.

13. The lasing SOA apparatus of claim 1 further comprising a pump source, coupled to the power monitor and the lasing SOA, that pumps a gain medium within the lasing SOA in response to the power monitor.

14. The lasing SOA apparatus of claim 1 further comprising:

a buffer, coupled to the first lasing SOA, that delays the optical signal by storing the optical signal; and

a second lasing SOA, coupled to the buffer, that further amplifies the optical signal.

15. The lasing SOA apparatus of claim 14 further comprising a pump source, coupled to the power monitor and the second lasing SOA, that pumps a gain medium within the second lasing SOA above a lasing threshold.

16. The lasing SOA apparatus of claim 14 wherein the buffer electrically stores data within the optical signal.

17. The lasing SOA apparatus of claim 14 wherein the buffer optically stores data within the optical signal.

18. A lasing SOA output power detection and control system comprising:

a plurality of lasing SOAs for amplifying at least one optical signal and further for outputting a ballast laser signal which acts as a ballast with respect to the amplification of the at least one optical signal;

at least one detector, positioned proximate to at least one lasing SOA within the plurality of lasing SOAs, to convert ballast laser signal from the at least one lasing SOA to an electrical signal; and

a power monitor, coupled to the at least one detector, for analyzing the electrical signal and determining a power level of the at least one optical signal.

19. The detection and control system of claim 18 wherein the at least one lasing SOA and the at least one detector are integrated on the same substrate.

20. The detection and control system of claim 18 wherein the at least one detector comprises a PIN diode.

21. The detection and control system of claim 18 wherein the at least one detector comprises an avalanche photodiode.

22. The detection and control system of claim 18 wherein the power monitor comprises at least one comparator that determines if the at least one lasing SOA is approaching saturation.

23. The detection and control system of claim 18 further comprising a pump source, coupled to the power monitor and the at least one lasing SOA, that pumps a gain medium within the lasing SOA in response to the power monitor.

24. A method for controlling an output power on a lasing SOA, the method comprising the steps of:

amplifying an optical signal as the optical signal travels through a lasing SOA:

outputting a ballast laser signal from the lasing SOA, wherein the ballast laser signal acts as a ballast with respect to amplification of the optical signal;

detecting the ballast laser signal; and

monitoring the power of the amplified optical signal by the detected ballast laser signal.

25. The method of claim 24 further comprising the step of controlling the output power of the lasing SOA in response to detected ballast laser signal.

26. The method of claim 25 wherein the output power of the lasing SOA is controlled by a pump source that pumps an active region within the lasing SOA.

27. The method of claim 24 wherein the lasing SOA has a laser cavity that is oriented vertically with respect to an amplification path of the optical signal.

28. The method of claim 24 wherein the lasing SOA has a laser cavity that is oriented horizontally with respect to an amplification path of the optical signal.

29. The method of claim 24 wherein the lasing SOA has a laser cavity that is oriented transversely with respect to an amplification path of the optical signal.

30. The method of claim 24 wherein a PIN diode detects the ballast laser signal of the lasing SOA.

31. The method of claim 24 wherein an avalanche photodiode detects the ballast laser signal of the lasing SOA.

32. The method of claim 24 wherein a comparator monitors the power of the amplified optical signal.

33. The method of claim 24 further comprising the steps of:

delaying the optical signal; and

controlling the output power of a second lasing SOA that further amplifies the optical signal in response to the detected ballast laser signal.

34. The method of claim 33 wherein the optical signal is delayed using an electrical buffer.

35. The method of claim 33 wherein the optical signal is delayed using an optical buffer.

36. The method of claim 33 wherein output power of the second lasing SOA is controlled by an adjustable pump source that pumps an active medium with the second lasing SOA.